

Understanding Information Resources for College Student Mental Health: A Knowledge Graph Approach

Xiaoyu Zhang¹ and Jiangping Chen¹[0000-0002-7016-4583]

¹ University of North Texas, Denton Texas 76203, USA
xiaoyu.zhang@unt.edu

Abstract. Many universities and colleges have not provided well-organized and easy to use mental health related information resources to their students although mental illness has become a significant barrier to college student success. This study aims to understand the information resources important to college student mental health (CSMH). We conducted a content analysis of two CSMH websites as the first step to build a knowledge graph for CSMH. Two site maps are developed based on the analysis. Seven types of information are therefore identified and considered important for colleges to provide to their students: Appointment, Mental Disorders, Self-help Resources, Information for Parents, Local Referral Sources, Substance Abuse Prevention, and University Policies on Mental Disorders. The next step of this study is to develop ontology by verifying the seven types of information and establishing their relationships. More CSMH websites will be examined to achieve reliable results.

Keywords: Information Resources, Knowledge Graph, Information Organization, Information Architecture, Mental Health Informatics, Content Analysis.

1 Introduction

According to the Suicide Prevention Resource Center (SPRC), one out of five college students experience a mental illness, and for a significant number of students, their emotional health and mental illness are becoming a barrier to their academic achievement, personal life, and society [1]. Researchers believed that both depression and anxiety have their peak onset in early adulthood, including college years. Depression and anxiety during college years could cause some negative consequences for students themselves, the school as a community, and society. It has been proved that depression and anxiety had a negative influence on students' academic performance and increased the possibility of students dropping out of college [2].

Responding to the rise of mental health on college campuses, some universities are taking serious actions. For examples, Northwestern University developed an app for students called Breathe (<https://www.northwestern.edu/breathe/>) to support healthy living and manage stress. The University of Pennsylvania developed a program called I CARE (<https://www.vpul.upenn.edu/caps/icare/>), an interactive gatekeeper training program for its students, faculty, and staff. Additionally, a few private and public

universities have established websites dedicated explicitly to counseling services for students seeking help for mental health problems. These sites organize mental health related information and services to facilitate easy access by their students, faculty, staff, and parents.

While the increasing demand for information and services on mental health in higher education institutions are real, little is understood what information and services should be provided to satisfy the needs of college students on mental health, and how the information should be organized to facilitate fast and easy access of college student mental health (CSMH) resources and facilities.

This study aims to understand the information presented at CSMH sites. The ultimate goal is to explore the processes of building a knowledge graph for CSMH so that universities could develop their CSMH services to meet the needs of students.

2 Related Studies

2.1 College Student Mental Health (CSMH)

Literature shows that college students were not immune to the suffering and disability associated with mental illness which may have significant implications for human capital on a societal level [3]. Unfortunately, a considerable number of students who are experiencing mental health difficulties will not report to the university or not utilize support services [4]. Risk factors for mental disorders among students and their relationships have been studied by several researchers [5], [6], [7] but still need much more exploration [3].

Noble and Douglas [8] stated that patients and family members of the mental illness would want more “information and involvement in decision-making, good relationships with providers, clear management plans, good coordination among services, the opportunity to record their wishes in advance directives, and contact with fellow patients who can provide peer support” (p. 299). However, very few studies that specifically investigate these needs among college students existed.

2.2 Information Organization on the Internet

Information architecture concerns how information could be organized so it is easy for users to access and use [9]. Use-centered website design methodology helps developers to generate websites that reflect the needs of the users [10]. To design or to understand a website, sitemaps and wireframes are important tools [9]. Sitemap presents not only information items but also their connections, which provide a big picture of a site on information organization. This study applies sitemaps to understand the information resources of two college CSMH sites.

2.3 Knowledge Graph and Its Construction

The concept of knowledge graph is getting popular in recent years with the introduction of Google’s Knowledge Graph in 2012 [11]. However, it is not new to infor-

mation scientists. According to Ehrlinger and Wolfram [12], a knowledge graph “acquires and integrates information into an ontology and applies a reasoner to derive new knowledge.” Franco-Salvador, Rosso, and Montes-y-Gómez [11] considered a knowledge graph as “a subset of an original knowledge base focused on the concepts pertaining to a text,” and “a weighted and directed graph that expands and relates the concepts belonging to a text.” In other words, a knowledge graph can describe the concepts and relationships as related to a subject of interest, which could be later used for different purposes. Knowledge graph has been widely used in areas such as data mining [14], education [15], natural language processing [16][17], and search and retrieval [18].

Most knowledge graphs follow a standard construction process in which an ontology must be defined [19]. An ontology usually specifies shared concepts and their relationships for a real-world subject/situation. It can be manually or automatically constructed. A knowledge graph can be constructed once the ontology is established, by extracting values for entities, attributes of entities, and the relationships between entities from texts.

3 Research Design and Methodology

This research aims to investigate information presented at CSMH sites and to build a preliminary ontology for CSMH. This investigation is the first step towards building a knowledge graph for CSMH services.

To understand information presented at CSMH sites, we conducted a content analysis of two universities websites on consulting service. A public university and a private university are chosen, which are called University A and University B in this paper. These two schools are selected because they presumably have an infrastructure that could facilitate the resources to be disseminated.

Data collection and analysis took place in three stages: First, develop sitemaps based on a metadata and content analysis these two websites. Sitemaps are also called blueprints; they provide the overall architecture of information organization of the institutions on CSMH. It facilitates not only the review of the information content of each site, but also the comparative analysis of the two sites. Second, we cross-checked the two sites with the National Institute of Mental Health (NIMH) list of the 16 types of mental disorders to examine the coverage of the sites on these mental disorders. This examination provides a general assessment of the completeness of the sites on mental disorders. Third, we performed a simple quality assessment of the two sites. Among many of the quality measures for website usability, we chose to focus on: (1) the existence and qualities of counseling services, and (2) the characteristics of mental health-related information. To identify the characteristics of the mental health information, we want to focus on ease of use, clarity, and comprehensiveness of information. Therefore the websites were assessed using several suggested quality measures [20], [21]: (a) clarity and extensiveness of definitions of types of mental illness/disorders, (b) interconnectedness between mental health and drugs/alcohol, (c)

information available to peers/family, and (d) information about advocacy and treatment services.

The results of the above analysis are presented in the next section. Furthermore, based on the results of the comparative analysis, we identified the commonalities and differences of the two sites, which help us to determine the essential components of a knowledge graph on CSMH. A preliminary CSMH ontology is therefore developed.

4 Results

4.1 Sitemaps of Two College Counseling Services

The sitemaps of the two universities are presented in Fig. 1 and Fig. 2 respectively. For each sitemap, the top block provides the content or links on the homepage, the middle block is the navigation menu on the homepage, and the rectangles below the middle block are the hyperlinks under each item on the navigation menu.

Specifically, Fig. 1 shows that University A provides 8 hyperlinks on its homepage, including Services, News and Posts, Crisis Text Line Website, Your online resources for college mental health, Therapy Assistance Online, About Counseling, About Testing, How do I make an Initial Appointment? and Live Chat. There are 6 items on its navigation menu: About Us, Services, Resource and Self-Help, Innovations in College Counseling, Calendar, and Contact. The site map also shows that there are many more pages under “Services” and “Resources and Self-Help.” The university also made efforts to present the innovations in the counseling services.

Fig. 2 shows that University B provides 13 items on its homepage under the “Counseling Services” menu. Personal Counseling, Student Self-Help Library, Parent Resources, Local Area Referral Sources, Substance Abuse Prevention Service, Support Groups and Resources, University Policies and Resources for a drug free campus these items contain more subpages under them. This university made efforts to provide Substance Abuse Prevention related information resources, including services, classes, and policies.

4.2 Mental Disorders Coverage

Our analysis found that neither site provides complete information covering the 16 types of mental disorders listed by the National Institute of Mental Health (NIMH). Table 1 presents the review results. From University A’s site, we could find information of 11 out of the 16 mental disorders while University B covers only 8 out of the 16. This indicates that students would not be able to obtain information regarding those disorders not covered, such as Borderline Personality Disorder from their university counseling sites.

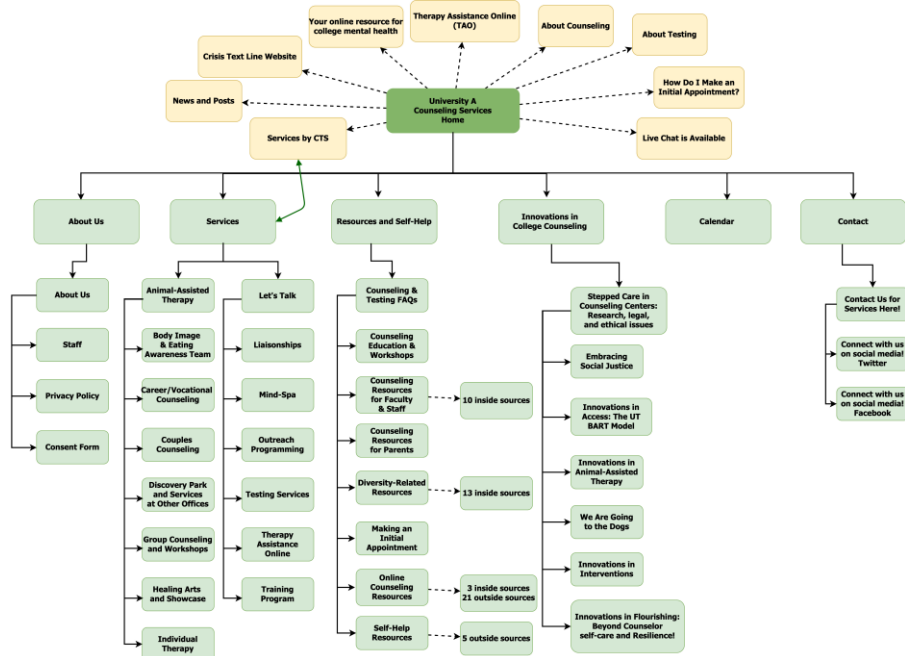


Fig. 1. University A's Counseling Services sitemap

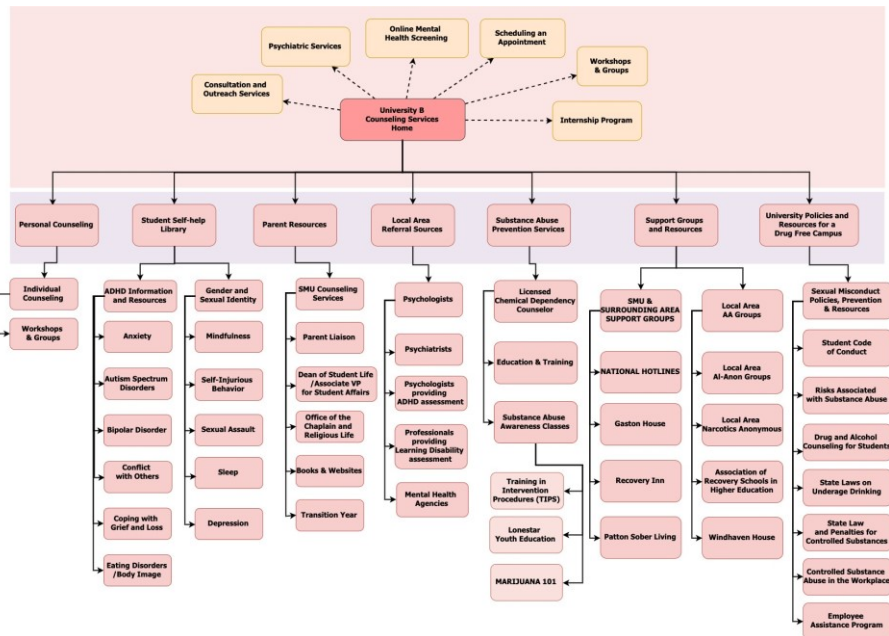


Fig. 2. University B Counseling Services sitemap

Table 1. NIMH 16 types of mental disorders.

NIMH 16 types of mental disorders	Site A	Site B
Anxiety Disorders	Yes	Yes
Attention Deficit Hyperactivity Disorder (ADHD, ADD)	Yes	Yes
Autism Spectrum Disorders (ASD)	No	Yes
Bipolar Disorder (Manic-Depressive Illness)	Yes	Yes
Borderline Personality Disorder	No	No
Depression	Yes	Yes
Disruptive Mood Dysregulation Disorder	No	No
Eating Disorders	Yes	Yes
HIV/AIDS and Mental Health	No	No
Obsessive-Compulsive Disorder (OCD)	Yes	No
Post-Traumatic Stress Disorder (PTSD)	Yes	No
Schizophrenia	Yes	No
Seasonal Affective Disorder	No	No
Substance Use and Mental Health	Yes	Yes
Suicide Prevention	Yes	Yes
Traumatic Events	Yes	No

4.3 Website Quality Assessment

The website quality assessment we conducted is a simple one to just reviewing four key aspects that were mentioned in literature important for college students. The results are presented in Table 2. As mentioned in 4.2, the two sites have different coverage on the 16 types of mental disorders. They all provide interconnectedness between mental health and drugs/alcohol, information to peers/family, and about advocacy and treatment services.

Table 2. Website assessment results.

Qualities	A	B
Clarity and extensiveness of definitions of types of mental illness/disorders	11 types	8 types
Interconnectedness between mental health and drugs/alcohol	Yes	Yes
Information available to peers/family	Yes	Yes
Information about advocacy and treatment services	Yes	Yes

5 Discussion

5.1 Commonalities and Differences

From Figure 1 and 2, we can see the commonality between the two sites: (1) provide link to make an appointment with the university counseling service; (2) provide information regarding the most common mental disorders, such as depression, ADHD, and eating disorders; (3) provide self-help resources; and (4) make information available to parents.

However, A's websites do not include any referral sources, while B has a whole page of local area referral sources broken down into different specialties. Another noticeable difference is that B's homepage contains a lot of information regarding substance abuse prevention, including services, classes, support groups, policies, and laws. But there is no obvious information about substance abuse at A's site. The information can only be found through a keyword search or going to the "Self-Help Resources" section, two-level under the homepage. Previous study has shown that one of the significant reasons that student with mental disorder are not willing to get help is because they are unsure of the university policy. Scholars suggested that to avoid the unintended consequence of decreasing a student's willingness to seek mental health services, the university should revisit policies requiring some students receiving campus mental health services to take a leave of absence [3].

5.2 Important Information Types and Entities

Based on the literature and the comparative analysis of the CSMH sites, we believe that seven types of information are essential to provide on university counseling services homepage. In addition to the four that both of the universities are providing, we recommend adding the following three information resources: local referral sources, substance abuse prevention resources, and university policies on mental disorders. Table 3 lists the seven types of information resources for CSMH.

Table 3. Recommendation of must provide information resources.

Information Types	Description/ Example
Appointment	Link for students to login and make appointment for the university counseling service
Mental Disorders	Basic information of different types mental disorders, such as depression, ADHD, and eating disorders.
Self-help Resources	Information about resources for mental health.
Information for Parents	Mental health information resources for Parents
Local Referral Sources	Local referrals for assessment, treatment, and medication for mental health issues and Learning Disorders/ADHD.
Substance Abuse Prevention	Information about substance abuse prevention, support groups, classes, training, and so on.
University Policies	University policies guidelines for students who has mental disorders conditions.

The seven types of information constitute major entities of the ontology for a knowledge graph in CSMH. A preliminary ontology can therefore be drawn as in Fig. 3.

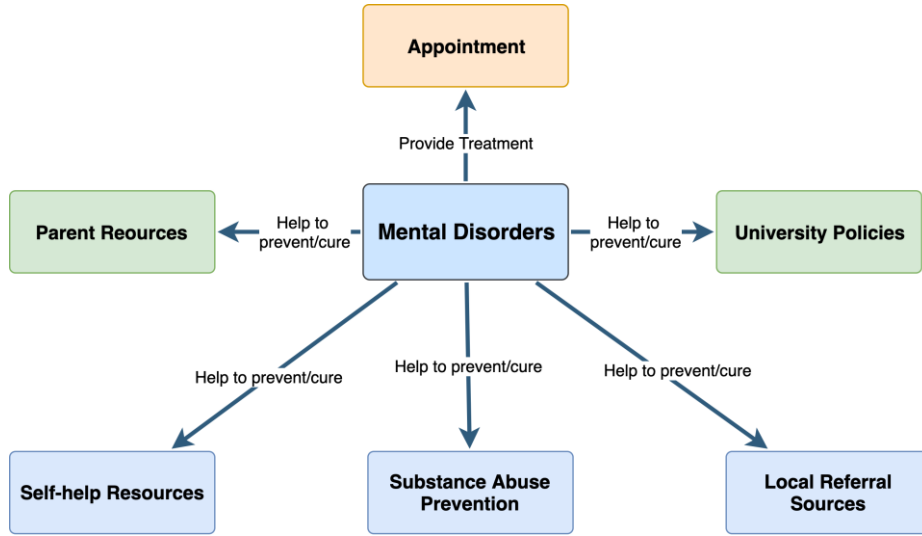


Fig. 3. An ontology for College Student Mental Health Service

6 Summary and Next Steps

The social, institutional, and psychological difficulties college students face during their college years are well explored, as are the negative mental health consequences that often arise as a result of these difficulties. The university division that is predominantly responsible for student mental health is the university counseling center. Counseling center directors are increasingly recognizing the importance the university website plays in providing wellness information to students, as well as notifications regarding counseling services and educational outreach activities. This study identifies major types of information that are essential to be organized and provided for college student mental health through a content analysis of two college sites. It provides guidance for universities to choose appropriate information and to better organize information on their CSMH sites.

Our future study will include: (1) to analyze more university CSMH sites to verify and enrich the ontology; (2) to perform information extraction and data mining and build the prototype of a knowledge graph for one of the universities. Our ultimate goal is to build a high-quality knowledge graph in college student mental health.

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